

PRODUCT ASSURANCE OF MEMS AND MICROSYSTEMS

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Biography

Frank Hartley has a background in the development of real-time-computing measurement control and analysis systems. At JPL he has been actively involved in the development of a variety of micromachined devices and 'smart' sensors and effectors. He has been at JPL for eight years as Supervisor of the Advanced Test and Measurement Group and more recently as Senior Technical Staff working on special projects. Prior to joining JPL he had been a business partner in numerous control system engineering tasks, in areas of transport, aviation, communications, medical, agricultural, defense, industrial and power utilities, as manager and engineer. He is a prolific innovator of technology and holds both foreign and USA patents. He received B.S. degrees in both Applied Physics and Electrical Engineering from the Royal Melbourne Institute of Technology and a M.S. degree from Cambridge University UK.

Abstract

Many of the leading manufacturers in the MEMS industry have recognized that the inadequate assessment of manufacturing issues, including reliability, packaging, testing and failure mode analysis, have been a major barrier to the commercialization of MEMS technology. To build and integrate reliable robotic spacecraft it is necessary to understand failure and degradation mechanisms. JPL has successfully applied coherent design and qualification methodologies to identify the critical parameters, methods and tools required for the ultra-low volume manufacture of ultra-reliable, macro-sized spacecraft. Much of this capability directly translates to the arsenal of

tools needed to determine yield, contamination and fatigue problems with MEMS devices.

The days of large spacecraft are over and micro spacecraft/sciencecraft require ultra-reliable, MEMS sensors and actuators for both spacecraft engineering bus and instrument payload. The ultra-low volume manufacture of MEMS by NASA or other research establishments precludes proof of process assurance. Assurance of MEMS devices requires thorough process validation, proof of process build and detection by inspection - all procedures requiring stable, mature and large scale production programs.

To address this dichotomy JPL created the MEMS Product Assurance Consortium consisting of organizations that had stable, mature and large scale production programs for MEMS that are deployed in the arduous automotive, display and medical environments.

Industrial consortia partners provide their MEMS devices to JPL for evaluation, actively participate in workshops to share ideas and knowledge with fellow consortium members, achieve solutions to MEMS quality and reliability problems, and accelerate the growth and acceptance of MEMS as commercial devices. JPL consolidates its business of the design, development and manufacture of small volume production ultra-reliable spacecraft by drawing on the applicable reliability information from the consortium's large scale production programs. The synergy here is a truly win-win approach to doing business which will help identify failure mechanisms and paths to improvements - a means for making the US MEMS industry competitive.